# FLAVOURING METHODS OF GAHARU TEA

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Abstract— Tea is one of the most consumed beverages in the world. While gaharu tea holds many benefits, the bitter taste makes it hard for consumer to drink this tea. Therefore this research objective is to study the best methods to flavour gaharu tea, the best flavour to infuse with the gaharu tea and the effect of adding flavour to antioxidant properties of gaharu tea. There are three methods of flavouring gaharu tea which is inclusion method, artificial flavouring method and mixture of both method. Inclusion methods is where chunk of dried fruits is added into the tea leaves and mixed together evenly. Artificial flavouring is where artificial flavours were sprayed on top of the leaves and mixed evenly. Lemon, strawberry and mint flavour are used in this experiment. Based on the DPPH assay, the scavenging activities for original gaharu tea is 85.43%. Lemon artificial flavouring methods indicates the highest scavenging activities which is 95.22%. Meanwhile, the pH of original gaharu tea is 6.30 which is neutral. Addition of lemon chunk makes the tea acidic which lowers the pH to 3.00. Flavour test was conducted among 20 participant to find out the best flavour. They were required to try all the tea with different flavour and different flavouring methods. The most favourable flavour is lemon flavour and the best method in flavouring gaharu tea is mixture of inclusion and artificial flavouring method.

# Keywords— Antioxidant, artificial flavour, flavouring methods, gaharu tea, pH

### I. INTRODUCTION

Tea is a drink derived from the extract of tea plant (Camellia Sinensis) and it is considered as the second most widely consumed beverage after water due to the great benefits it offers [1]. Tea is a type of phytotheraphy as despite of its pleasant aroma and flavour, it also has nutritional properties, reduce cancers, boost immunity and enhance the heart functionality. Generally, the manufacturing process of tea will determine the type of tea and widely known types are green tea, black tea and oolong tea [2]. Besides that, tea is also categorized by the different type of plant used, part of the plant used and the location of the production. Therefore, many type of tea emerges from various plant and herbs used and each tea has its own specialty whether in taste, aroma, functionality or its nutritional properties. Chemical constituents of tea consist of polysaccharides, sterols, amino acids, various vitamins, minerals, proteins, organic acids and volatile compound [3].

Besides the consumption of pure tea, flavouring are also added to improve the fragrance and flavour of the tea. The flavour of tea can be divided into two categories which are aroma (volatile compound) and taste (non volatile compound)[4]. Other plant or fruit extracts such as rose (Rosa Rubiginosa), lemon (Citrus Limon) and strawberry (Fragaria × ananassa) are added to create new aroma and taste for the tea. There are countless possibilities to flavour tea in order to create new exciting beverage while maintaining the magnificent properties of tea.

Agarwood tea is a tea produce from the leaves of Agarwood plant in genus Aquilaria. Agarwood has many applications such as perfumery, incenses, medicine, religious ceremony and ornamental [5]. Agarwood demand is very high in the market despite the high price. In order to harvest Agarwood, it is important to wait for the plant to mature first, which will usually take five to seven years. Between these time, farmers opt to sustain their living by exploring other alternatives of this plant such as producing tea from the Agarwood leaves [6]. Agarwood tea is said to bring many benefits such as treating digestive ailment, high blood pressure, constipation, headache and diabetes [7]. Currently, the use of Agarwood leaves comes in many form in the market as in the forms of tea in sachets, biscuits and ice creams [8].

In order to flavour tea, there are three basic approach, which is addition, coating and scenting. Usually, more than one methods are used in order to get the favourable flavour. Type of flavouring of tea are inclusions, nature identical flavouring agents, extracts, and artificial flavours. Inclusions are the addition of chunk of fruits, pulps, herbs or spices into the tea leaves and dried all together. Extracts are agents of flavouring by extracting essentials oil from the fruits, leaves, buds, roots or any other part of plants. This methods carry distinctive scents or flavours from the plant that are being extracted. Some extraction are very simple such as squeezing lemon to get the juice, some are much complex such as soaking vanilla beans into alcohols.

Flavouring tea sometimes takes more than one approach to acquire the desired taste. Inclusion does give the scent and taste of the plants or fruits, but it is still not enough. Therefore, the use of nature identical flavouring agent is used to fill in the void left by the inclusion technique. Artificial flavours sometimes being used to flavour tea. Mixture of inclusion and artificial flavouring method will create a tea with wonderful taste and scentful aroma.

## II. METHODOLOGY

# A. Materials

Material used to conduct this research is Aquilaria Subintegra leaves. The leaves collected and plucked from the farm at Jalan Kebun, Shah Alam. Young leaves which are free from disease is chosen for this experiment. The leaves is collected on January 2019. The leaves is required to undergone cleaning process by rinsing with running tap water to remove impurities and dirt. Then, the A. Subintegra leaves is arranged on the tray and wiped until dry using dry tissue to remove the excess water from the cleaning process. Lemon, strawberry and mint are bought from Aeon Jusco Seksyen 13, Shah Alam. Meanwhile, the lemon, strawberry and mint artificial flavor (Star Brand) were bought from Giant Seksyen 7, Shah Alam. The fruit is rinsed using running tap water and then dried using tissue. The fruits is cut into chunk with thickness of 1 cm.

# B. Materials Preparation Procedure

- 1) The collected leaves were put inside a basket.
- 2) The leaves were rinsed by using running tap water.
- 3) The leaves were wiped using lab tissue.
- 4) The leaves were sorted on the tray evenly.

# C. Drying Procedure

- The leaves were put on the tray before place inside the VFIR dryer.
- 2) Temperature and pressure were set on 60°C and 0.6 bar.
- 3) The tray was placed inside the VFIR dryer and run for 120 mins
- 4) Tray were taken out from the VFIR dryer.
- 5) The leaves were cooled down for 5 mins at room temperature.
- 6) Step 1 to 5 were repeated using lemon, strawberry and mint leaves for 8 hours, 6 hours and 20 minutes respectively.

#### D. Inclusion Method Procedure

- 1) Dried leaves and lemon fruits mixture were grind using the dry mill for 30 seconds.
- 2) Weighed the grind leaves and fruits mixture for 2 gram using weighing balance as a sample.
- 3) Insert the mixtures into a tea bags.
- 4) Repeat step 1 to 3 using the mint and strawberry mixtures.
- 5) Total of 30 samples were prepared for taste and chemical analysis (pH and anti oxidant) based on different variables.
- 6) The analysis result was recorded to see the comparison of each flavour.

#### E. Artificial Flavouring Procedure

- 1) Dried leaves were grind using the dry mill for 30 seconds.
- 2) The dried leaves were spreaded evenly on a tray.
- 3) The dried leaves were sprayed with nature identical lemon flavouring until all surface is covered.
- 4) The grounded leaves were weighed for 2 gram using weighing balance as a sample.
- 5) The flavoured tea were inserted into a tea bags.
- 6) Step 1 to 3 were repeated using the mint and strawberry nature identical flavouring.
- 5) Total of 30 samples were prepared for taste and chemical analysis (caffeine and anti oxidant) based on different variables.
- 6) The analysis result was recorded to see the comparison of each flavour.

# F. DPPH Procedure

DPPH radical scavenging capacity was performed using the method of Mohsen and Ammar[9]. The DPPH• scavenging effect was calculated as follows:

DPPH scavenging effect (%) = (1-Asample/Acont) x 100

where Asample and Acont were defined as the absorbance of the samples and the control, respectively.

- 1) Tea liquor was prepared by soaked 1 sample into the 100mL of hot distilled water with temperature 100°C in a beaker for 2 minutes.
- 1mL of 0.2 mM DPPH is allowed to react in 100mL of methanol.
- 3) 1 mL of tea liquor is allowed to react with 1mL of 0.2mM DPPH in 100mL of methanol
- 4) The mixture is then incubated in a dark at room temperature for 30 minutes.
- 5) The absorbance of the mixture against water is recorded and

labelled as blank.

- 6) Repeat step 1-5 for all samples
- 7) The result was recorded

#### G. Flavour Test Procedure

- Tea liquor was prepared by soaked 1 sample into the 100mL of hot distilled water with temperature 100°C in a beaker for 2 minutes.
- 2) 50 gram of sugar is added into the liquor.
- 3) The liquor is given to the test subject to judge the taste.
- 4) The respond of participant is recorded.
- 5) Repeat step 1 to 5 using all the other tea sample.
- 6) Repeat step 1 to 6 to 20 test subject.
- 7) The result was recorded

# H. pH Test Procedure

- 1) Tea liquor was prepared by soaked 1 sample into the 100mL of hot distilled water with temperature 100°C in a beaker for 2 minutes.
- 2) pH meter is dipped into the liquor for 5 minutes
- 3) Repeat step 1 to 2 using all the other tea sample.
- 4) The result was recorded.

## III. RESULTS AND DISCUSSION

Table 1: DPPH Scavenging activities and pH of sample

# *A.* The effects of adding flavours on Antioxidant scavenging activities and pH value of gaharu tea.

Sample	DPPH	pH
	Scavenging (%)	
Pure Gaharu	85.43	6.30
Lemon	92.00	3.30
Inclusion		
Strawberry	85.09	6.50
Inclusion		
Mint	93.83	6.25
Inclusion		
Lemon	95.22	4.45
Flavouring		
Strawberry	85.30	6.20
Flavouring		
Mint	92.48	5.35
Flavouring		
Lemon Mix	94.04	3.00
Strawberry Mix	85.78	6.15
Mint Mix	95.26	4.20

Some methods recommended to measure antioxidant scavenging activities are DPPH assay, ABTS assay and FRAP assay [10]. In this research, DPPH assay were used to determine the antioxidant scavenging activities. Base on Table 1, the pure gaharu tea indicates scavenging activities of 85.43%. Comparing to pu erh tea research [11], the range were from 81.56% to 94.10% for green tea. Therefore, it is in good range for green tea antioxidant properties. This can be said because Fuzhuan and Liubao tea studies, the range of scavenging activities are 79.62% to 95.58% and 76.02% to 87.40% respectively [12].

All three methods using lemon base increases the DPPH scavenging activities by significant amount up to 95.22%. Lemon Inclusion method signified the lowest amount of % in all lemon base method which is 92.00% and the highest is Lemon artificial flavouring method which is 95.22%. Meanwhile the mixture of inclusion and artificial flavouring method is 94.04%. It can be concluded that lemon increases the antioxidant properties in gaharu tea.

Strawberries base flavouring methods indicates less changes from the original pure gaharu antioxidant scavenging activities. The activities recorded were 85.09% for strawberry inclusion method, 85.30% for strawberry artificial flavouring method and 85.78% for mix of both method. Therefore, strawberries flavouring methods does not change the antioxidant properties of gaharu tea.

Addition of mint flavouring whether inclusion of mint leaves, mint artificial flavor or mixture of both methods increases the antioxidant properties inside the gaharu tea. This can be seen from the result recorded where for mint inclusion method the scavenging activities is 93.83%, 92.48% for mint artificial flavouring and 95.26 for mixture of both technique.

For pH value, the duration of brewing does affect the pH of the tea [13]. The higher the brewing time, pH will go lower. But in this research, the brewing time is merely 2 minutes, therefore there is no significant change in pH. pH will also affect the EGCG of the tea, hence the antioxidant properties of the tea [14]. The pH from 1 to 9 will significantly affect the EGCG but not the antioxidant properties [15]. For pure gaharu tea, the pH recorded was 6.30.

Lemon flavouring methods indicates the lowest pH of all methods. The pH recorded for lemon inclusion method is 3.30, 4.45 for lemon artificial flavouring and 3.00 for mixture of both method. This is due to the fact that lemon is acidic. The sour the tea, the lower the pH of the tea [16].

For strawberries flavouring methods, the change of pH is not significant compared to the original pure gaharu tea. It is recorded the pH for strawberry inclusion method is 6.5, 6.2 for strawberry artificial flavouring method and 6.15 for mixture of both methods. This can be said because of the pH of strawberry is neutral which is from 6 to 7.

Mint flavor indicates different range of pH for each method. For mint inclusion, the pH is 6.25, 5.35 for mint artificial flavouring and 4.2 for mixture of both method. The pH of the mix method is lower is maybe due to the reaction of chemical constituent inside mint leaves and the artificial flavouring.

From these findings, addition of flavor inside gaharu tea does not lower, in fact, increases the antioxidant properties of gaharu tea. Meanwhile, pH does affect the EGCG of tea but does not affect the antioxidant properties of tea. Addition of acidic fruits such as lemon or other acidic fruit is possible without harming the potential of gaharu tea.

## B. Flavour test analysis

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20



Flavour Test Score

Fig. 1: Flavour test score result

Flavour test analysis is done by giving questionnaire to 20 participant. They are given task to taste each tea brewed by addition of 50 gram sugar to diminish the bitter taste of the gaharu tea. This is because gaharu tea taste is very bitter than everyday normal tea in the market [17]. Figure 1 shows the score given by the participant for each flavor for each method. There are four type of score which are 1, 2, 3 and 4 which indicates very bad, bad, good and very good respectively.

For the blank or pure gaharu tea, even with addition of water, there are 4 participant marked the tea taste as very bad. And none scored the tea as very good. 11 participant indicates the tea has bad taste and 5 participant suggest that the tea taste good. The reason this 5 participant score the tea as good is because they are accustomed to drinking tea without the addition of sugar. For lemon flavours, the lemon inclusion method received solid 3 score from all 20 participants. This may be due to the sweet aroma of dried lemon chunk which upholds the sweet and sour taste of the tea. For artificial flavouring, 2 participant indicates the taste as bad and 18 indicates the taste as good. This may be due to less sweet and lemon-ish taste in the artificial flavor. For the mixture of both methods, 15 participants scored good and 5 participants says the taste is very good. The mixture of artificial flavor and dried lemon chunk significantly enhance the taste and aroma of the tea.

For strawberry flavourings, inclusion method received 3 bad score and 17 good score. Artificial flavor received 7 bad score and 13 good score. Meanwhile mixture of both method received 14 good score and 6 very good score. Base on the feedback of participant, the inclusion method is not sweet enough and artificial flavouring is less sweet than inclusion. But the mixture of both methods increases the sweetness and the strawberry taste of the tea. Therefore, resulting in very good score to be voted by 6 participants.

Mint inclusion methods received score of 6 for bad taste and 14 for good taste. Artificial flavor methods received 9 bad taste and 11 good taste. Meanwhile mixture of both methods received 1 bad taste, 16 good taste and 3 very good taste. Based on the participants review, the mint flavor only adds the cool sensation and no sweetness or any other unique flavor. They suggest addition of sugar, then only the tea will taste very nice. Even though the taste is mild and not good enough a study indicates that mint leaves when combined with green tea will enhance the effect of inhibition of pathogen inside the body [18].



Fig. 2 : Most favoured flavor votes.

The 20 participants in this experiments were required to vote which is the best flavour out of all the three flavours. 13 participants voted for lemon flavour and 7 participants voted for strawberry flavours and none voted for mint flavours. Base on their review, lemon flavours has the sweetness and aroma added into the tea. Hence, their choice of the best flavour.

# IV. CONCLUSION

This research indicates that addition of flavour may affect the pH and antioxidant properties of the gaharu tea. Even though pH is significantly changed with addition of lemon flavour, the antioxidant properties of lemon flavoured gaharu tea is heightened. Base on the participants response on the flavour test, it can be concluded that addition of lemon flavour diminish the bitterness and adds good flavour in gaharu tea. The addition of flavour will also change the aroma of the tea hence making it more scentful and appetizing. Further research can be done to investigate the effect of addition of flavour towards the polyphenol and caffeine of the gaharu tea. Various method of tea production can also be used such as black tea, white tea and brown tea. Other flavour can also be tested to open various and bigger possibilities in enhancing the flavour of gaharu tea. Example of flavours that can be used is banana, apple, peach, grape, ginger and kiwi. Different brewing methods will also affect the taste, aroma and chemical constituent of the tea. Different brewing time will affect the pH of tea. This study met its objectives which is to determine the best methods to flavour gaharu tea, best flavour to infused with gaharu tea and the effect of addition of flavours to chemical constituent inside gaharu tea.

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